UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/988,246	12/01/1997	SEBASTIEN RAOUX	AM1771-4-T19	7250

32588 7590 07/24/2003

APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

EXAMINER	
ZERVIGON, RUDY	
ART UNIT	PAPER NUMBER
1763	42

DATE MAILED: 07/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	08/988,246	RAOUX ET AL.	
	Examiner	Art Unit	
	Rudy Zervigon	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 May 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3-6,11-14,16,19,20,23,24 and 26-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3-6,11-14,16,19,20,23,24 and 26-30* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 3-6, 11-14, 16, 19, 20, 23, 24, and 26-30 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-5 of U.S. Patent No. 6,098,568 in view of Patrick et al (U.S.Pat. 5,474,648). Although the conflicting claims are not identical, they are not patentably distinct from each other because the present application does not claim the relative dimensions of the inlet and outlet holes for the gas inlet manifold as does the claims of U.S. Patent No. 6,098,568. Further, U.S. Patent No. 6,098,568 does not claim capacitors in the matching networks. And U.S. Patent No. 6,098,568 does not claim an impedance monitor comprising a first impedance probe electrically coupled to the high frequency electrode to measure the impedance at the HF electrode and a second impedance probe electrically coupled to the low frequency electrode to measure the impedance at the LF electrode.

Patrick et al teaches an impedance monitor (202, "RF Parameter Sensor", Figure 2A; column 7, lines 14-20) comprising a first impedance probe electrically coupled to an electrode to measure the impedance at the electrode. The monitor further measures the voltage, current, and phase angle at the chamber electrode (items 112 and 114; column 6, line 64), and measures the "impedance of the plasma chamber electrode" (column 3, lines 64-67).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to change the dimensions of the inlet and outlet holes for the gas inlet manifold as taught by U.S. Patent No. 6,098,568.

Motivation to change the dimensions of the inlet and outlet holes for the gas inlet manifold as taught by U.S. Patent No. 6,098,568 is for providing a desired pressure gradient across each hole of the inlet manifold. Further, it is well established that changes in apparatus dimensions are within the level of ordinary skill in the art.(Gardner v. TEC Systems, Inc. , 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied , 469 U.S. 830, 225 USPQ 232 (1984); In re Rose , 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); See MPEP 2144.04).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the Patrick impedance monitor coupled to each of the low and high frequency electrodes of U.S. Patent No. 6,098,568.

Motivation for using the Patrick impedance monitor electrically coupled to each of U.S. Patent No. 6,098,568's low and high frequency electrodes is directed to providing a chamber impedance

measurement and control for uniform processing as taught by Patrick (column 5, lines 57 – column 6, line 33).

3. Claims 3-6, 11-14, 16, 19, 20, 23, 24, and 26-30 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-6 of U.S. Patent No. 6,041,734 in view of Patrick et al (U.S.Pat. 5,474,648). Although the conflicting claims are not identical, they are not patentably distinct from each other because U.S. Patent No. 6,041,734 does not claim capacitors in the matching networks. And U.S. Patent No. 6,041,734 does not claim an impedance monitor comprising a first impedance probe electrically coupled to the high frequency electrode to measure the impedance at the HF electrode and a second impedance probe electrically coupled to the low frequency electrode to measure the impedance at the LF electrode.

Patrick et al teaches an impedance monitor (202, "RF Parameter Sensor", Figure 2A; column 7, lines 14-20) comprising a first impedance probe electrically coupled to an electrode to measure the impedance at the electrode. The monitor further measures the voltage, current, and phase angle at the chamber electrode (items 112 and 114; column 6, line 64), and measures the "impedance of the plasma chamber electrode" (column 3, lines 64-67).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the Patrick impedance monitor coupled to each of the low and high frequency electrodes of U.S. Patent No. 6,041,734.

Motivation for using the Patrick impedance monitor electrically coupled to each of U.S. Patent No. 6,041,734's low and high frequency electrodes is directed to providing a chamber impedance

measurement and control for uniform processing as taught by Patrick (column 5, lines 57 – column 6, line 33).

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 3, 4, 6, 11-14, 16, 19, 20, 24, 26, 28, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arami et al (U.S.Pat. 6,014,943) in view of Patrick et al (U.S.Pat. 5,474,648). Arami et al teaches:

i. A substrate processing system (1, Figure 1) using a plasma chamber (item 2, Figure 1; column 5, lines 1-18; column 6, lines 27-39) encasing a reaction zone

ii. A substrate processing system using a substrate holder (6, Figure 1; column 5, lines 18-36) as a low frequency (LF) electrode (column 6, lines 27-39; "several hundreds kHz")

iii. A gas distribution system (24-27; Figure 1; column 6, lines 15-26) including a gas inlet manifold (22; Figure 1; column 5, lines 56-67) for supplying one or more process gases to the reaction zone

iv. The gas inlet manifold comprising a high frequency (HF) electrode (22; column 6, lines 27-39)

v. A plasma power source (34, 31; Figure 1) for forming plasma within the reaction zone of the deposition chamber, the plasma power source comprising a high frequency power supply (34; column 6, lines 27-39; "27.12MHz") coupled to the HF electrode (22) and a low

frequency power supply (31; column 6, lines 27-39; "several hundreds kHz") coupled with the LF electrode (6)

vi. Matching networks (32, 33; column 6, lines 27-39) for each of the low frequency and high frequency electrodes respectively – Arami further teaches the matching network 33 is electrically coupled to a high frequency RF generator (34) and the gas manifold (22).

Arami does not teach capacitors in the matching networks.

However, matching networks are well known in the art as having capacitors as demonstrated by Patrick et al (see variable capacitors 106, 108 of matching network 120, Figure 2A)

Arami et al does not teach an impedance monitor comprising a first impedance probe electrically coupled to the high frequency electrode to measure the impedance at the HF electrode and a second impedance probe electrically coupled to the low frequency electrode to measure the impedance at the LF electrode.

Patrick et al teaches an impedance monitor (202, "RF Parameter Sensor", Figure 2A; column 7, lines 14-20) comprising a first impedance probe electrically coupled to an electrode to measure the impedance at the electrode. The monitor further measures the voltage, current, and phase angle at the chamber electrode (items 112 and 114; column 6, line 64), and measures the "impedance of the plasma chamber electrode" (column 3, lines 64-67).

12, 13, 14, 19 - Patrick et al additionally teach variable capacitors and tuners (items 106 and 108; Figure 2A; Page 28, line 6 of Applicant's Specification) of a matching network (120, Fig.2A). Patrick's variable capacitor is electrically coupled to the one of the plasma electrodes (112) and controllably coupled to the processor (204, column 7, lines 4-12) wherein the processor adjusts a capacitance level of the variable capacitor to vary the impedance of the plasma in response to an output of the impedance monitor.

Patrick et al further teaches a processor (204, Figure 2A) coupled with the impedance monitor (202; column 4, lines 35-40) for adjusting processing conditions (column 4, lines 2-18) of the deposition chamber based on measurements by the impedance probe.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the Patrick impedance monitor coupled to each of the low and high frequency electrodes of Arami et al.

Motivation for using the Patrick impedance monitor electrically coupled to each of Arami's low and high frequency electrodes is directed to providing a chamber impedance measurement and control for uniform processing as taught by Patrick (column 5, lines 57 – column 6, line 33).

6. Claims 5, 27, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arami et al (U.S.Pat. 6,014,943) in view of Patrick as applied to claims 3, 4, 6, 11-14, 16, 19, 20, 24, 26, 28, and 29 above, and further in view of Boys et al (U.S.Pat.4,500,408). Arami et al and

Patrick et al do not teach a pressure control system based on measured plasma attributes such as impedance. Boys et al describe plasma coating apparatus controlled in response to measurements of plasma parameters to control deposition parameters (abstract). Specifically, Boys et al describe:

vii. a pressure control system (column 12, lines 51-53) configured to control a pressure level within the chamber and controllably coupled to the processor wherein the processor controls the pressure control system to vary the pressure within the chamber in response to the measured impedance level of the plasma (column 22, lines 61-66)

Boys et al additionally teach a plurality of impedance measuring devices as manifested by plasma voltage and plasma current measurements (items 45, 46; Fig.1; column 11, lines 43-45).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the pressure control system as described by Boys et al to be an obvious extension to the Patrick et al impedance data collection and control system.

Motivation for implementing the pressure control of Boys et al based on measuring the plasma impedance as part of the Patrick et al impedance data collection and control system is directed "To control deposition rate and coating distribution accurately over a period of time, it is necessary to control both plasma voltage and plasma current for a specific plasma power. Plasma voltage and plasma current are a function of plasma impedance.....Thus the two variables that can be varied to control plasma impedance are the pressure of the working gas in volume 13 and the magnetic field applied by cathode assembly 17 to target 15 and volume 13." (Column 11, lines 40-45; lines 56-59).

7. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Arami et al (U.S.Pat. 6,014,943) and Patrick et al (U.S.Pat. 5,474,648) as applied to claims 3, 4, 6, 11-14, 16, 19, 20, 24, 26, 28, and 29 above, and further in view of in view of Yamagata et al (USPat. 5,362,358). Neither Arami nor Patrick teach a variable capacitor separate from the matching network.

Yamagata teaches a variable capacitors (24, 26, Figure 6) separate from the matching network (22) of a plasma processing chamber.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Patrick to add a variable capacitor separate from the matching network of a plasma processing chamber as taught by Yamagata.

Motivation for Patrick to add a variable capacitor separate from the matching network of a plasma processing chamber as taught by Yamagata is discussed by Yamagata as drawn to controlling the amount of power applied to each of the electrodes in the plasma reactor (column 1, lines 45-47).

Response to Arguments

8. Applicant's arguments filed May 13, 2003 have been fully considered but they are not persuasive.

9. Applicant's position that Patrick does not teach plural impedance probes is agreed by the Examiner. However, it is well established that the duplication of parts is obvious (In re Harza , 274 F.2d 669, 124 USPQ 378 (CCPA 1960) MPEP 2144.04). Added process control from providing plural impedance monitors would naturally result and would be obvious to one of ordinary skill as taught by Patrick (column 5, line 57 – column 6, line 34).

10. Applicant's position that "Measuring the impedance separately at the HF electrode and at the LF electrode can provide important information regarding the system and the process" is already well demonstrated by Patrick with the impedance measurement of one electrode using one impedance probe (column 7, line 61 – column 8, line 4).

11. Applicant's position that the Examiner does not allege that the variable capacitors in Patrick are different, Applicant is directed to the Examiner's assertion on page 7 of the prior action:

"

Patrick's variable capacitor is electrically coupled to the one of the plasma electrodes (112) and controllably coupled to the processor (204, column 7, lines 4-12) wherein the processor adjusts a capacitance level of the variable capacitor to vary the impedance of the plasma in response to an output of the impedance monitor.

"

as claimed by claims 16 and 20 and not by claim 23. The Examiner's assertion where "Neither Arami nor Patrick teach a variable capacitor separate from the matching network" is applicable to claim 23, not to claims 16 and 20, and is an added limitation further met by Yamagata et al (USPat. 5,362,358) as discussed above.

12. Applicant's position that the Examiner has not "pointed to any motivation to combine Yamagata et al with Arami et al and Patrick et al" is not accurate. As discussed both above and in the prior office action:

"

Motivation for Patrick to add a variable capacitor separate from the matching network of a plasma processing chamber as taught by Yamagata is discussed by Yamagata as drawn to controlling the amount of power applied to each of the electrodes in the plasma reactor (column 1, lines 45-47).

"

Conclusion

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633..

JEFFRIE R. LUND
PRIMARY EXAMINER